Field Investigations: CDC Perspective on Outbreak Investigations

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- Doug Hamilton, MD, PhD
  Chief, EIS Program

Why Initiate an Investigation?

- Characterize the problem
- Rational basis for control and prevention
- Research--answer scientific questions
- Training of epidemiologists
- Political / legal concerns
- Program considerations

Guidelines for Epidemiologic Field Investigations

- Prepare for field work
- Verify diagnosis
- Confirm epidemic
- Identify and count cases
  - create case definition
  - develop line listing
- Tabulate and orient data: time, place, and person
- Take immediate control measures
- Formulate and test hypothesis
- Plan additional studies
- Implement and evaluate control measures
- Initiate surveillance
- Communicate findings

CDC

Verify Diagnosis

- Goal is to rule out:
  - misdiagnosis
  - laboratory error
- Examine case-patient(s)
- Review medical records
- Confirm laboratory testing.

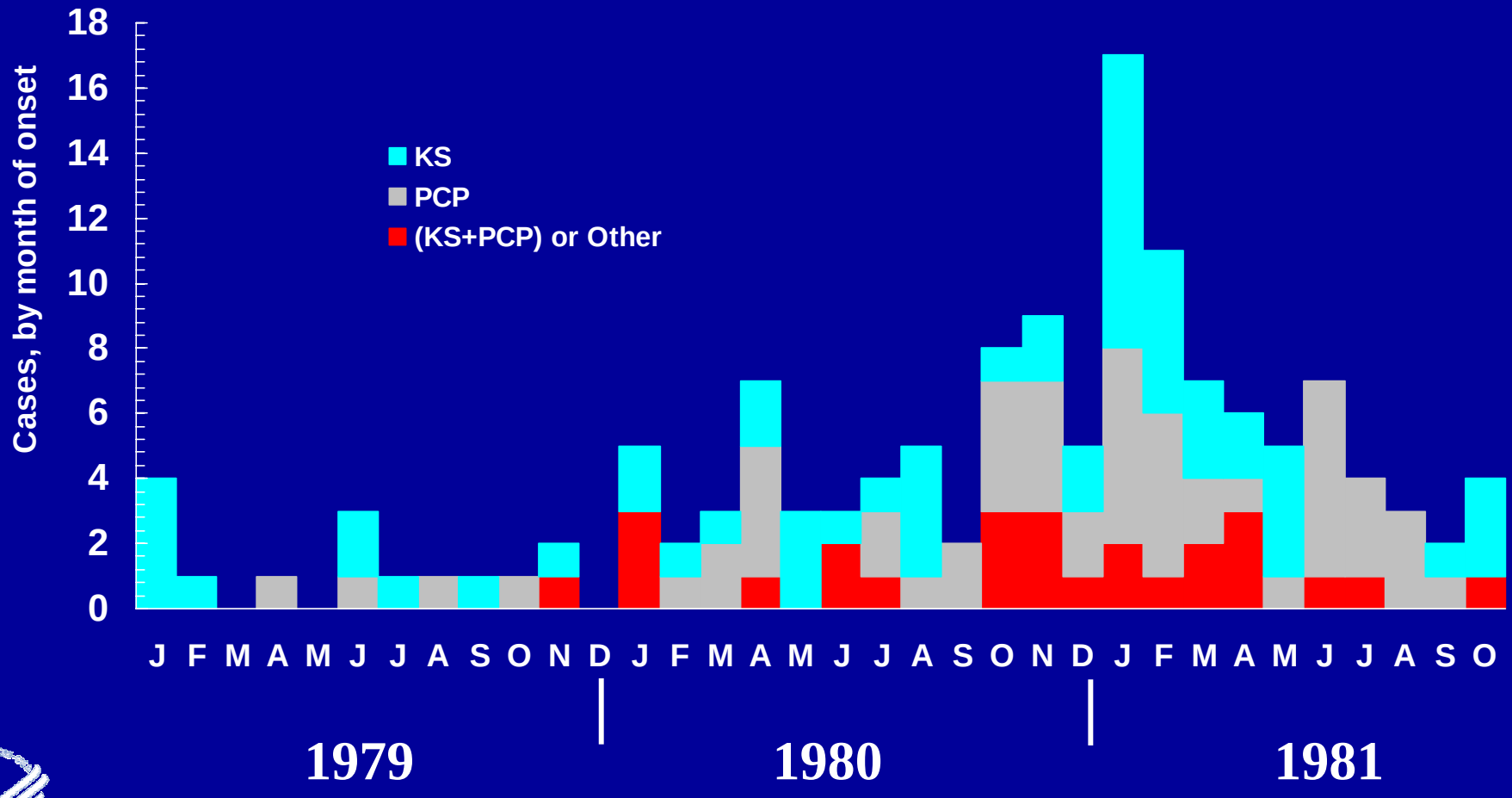
Confirm Epidemic

- **Establish baseline**

Confirm Epidemic

- Establish baseline
- Compare magnitude of present problem with baseline

Incidence of Kaposi's Sarcoma (KS), *Pneumocystis carinii* Pneumonia (PCP), and Other Opportunistic Infections in the U.S., 1979-1981



Identify and Count Cases

- Goals:
  - identify maximum number of cases
  - exclude noncases
- Consider spectrum of manifestations
- Develop case definition
  - set of conditions
  - specific time period
  - specific location

Case Definitions

Problem:

Outbreak of legionnaires disease in persons who had visited Bloomington Indiana

Case:

An illness characterized by pneumonia or fever and cough in a person who had been in Bloomington, Indiana, in the two weeks prior to onset of illness

Confirmed case:

Either 1) LDB in lung tissue by direct FA technique, or 2) a 4-fold rise in titer of serum antibodies by the IFA technique

Presumptive case:

A single convalescent specimen with a certain titer level

Identify and Count Cases

- Conduct systematic search
- Use multiple sources
- Construct a line list

Orient Data

- Time
- Place
- Person

Descriptive Epidemiologic Process

WHO was affected?

WHERE were they affected?

WHEN were they affected?

HOW and **WHY**?

Ordering Key Events

- Onset of manifestations in cases and contacts
- Period of exposure to causal agents or risk factors
- When treatments given
- When control measures implemented
- Potentially related events or unusual circumstances

Time

- Epidemic curve: # of cases by time of onset
- Configuration permits inferences
  - agent known: use incubation period to look back at exposure
  - agent unknown, but common event likely: postulate agent by determining the incubation period
- Construct relative to specific sites or groups
- Time intervals: less than known/suspected incubation periods

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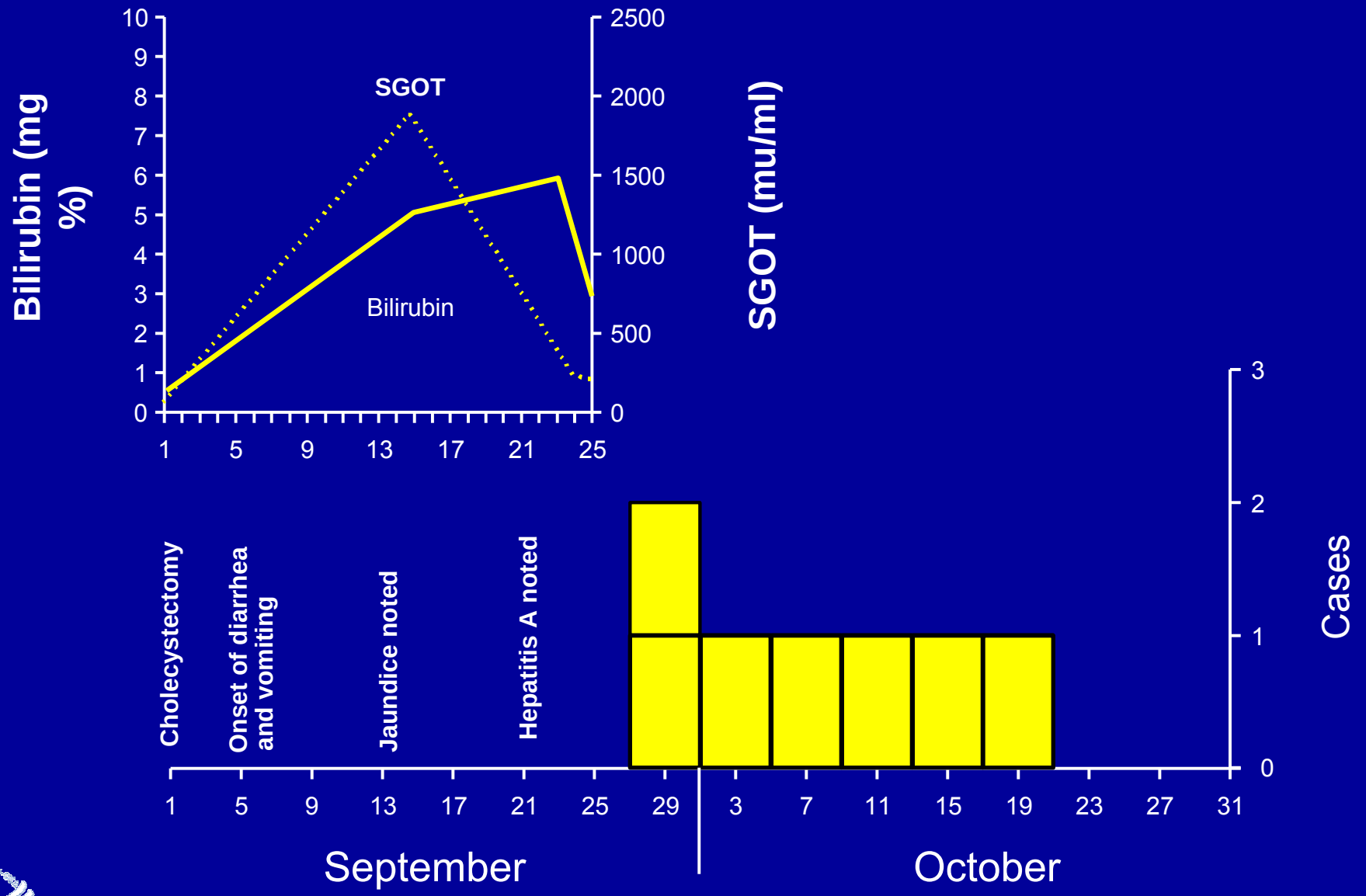
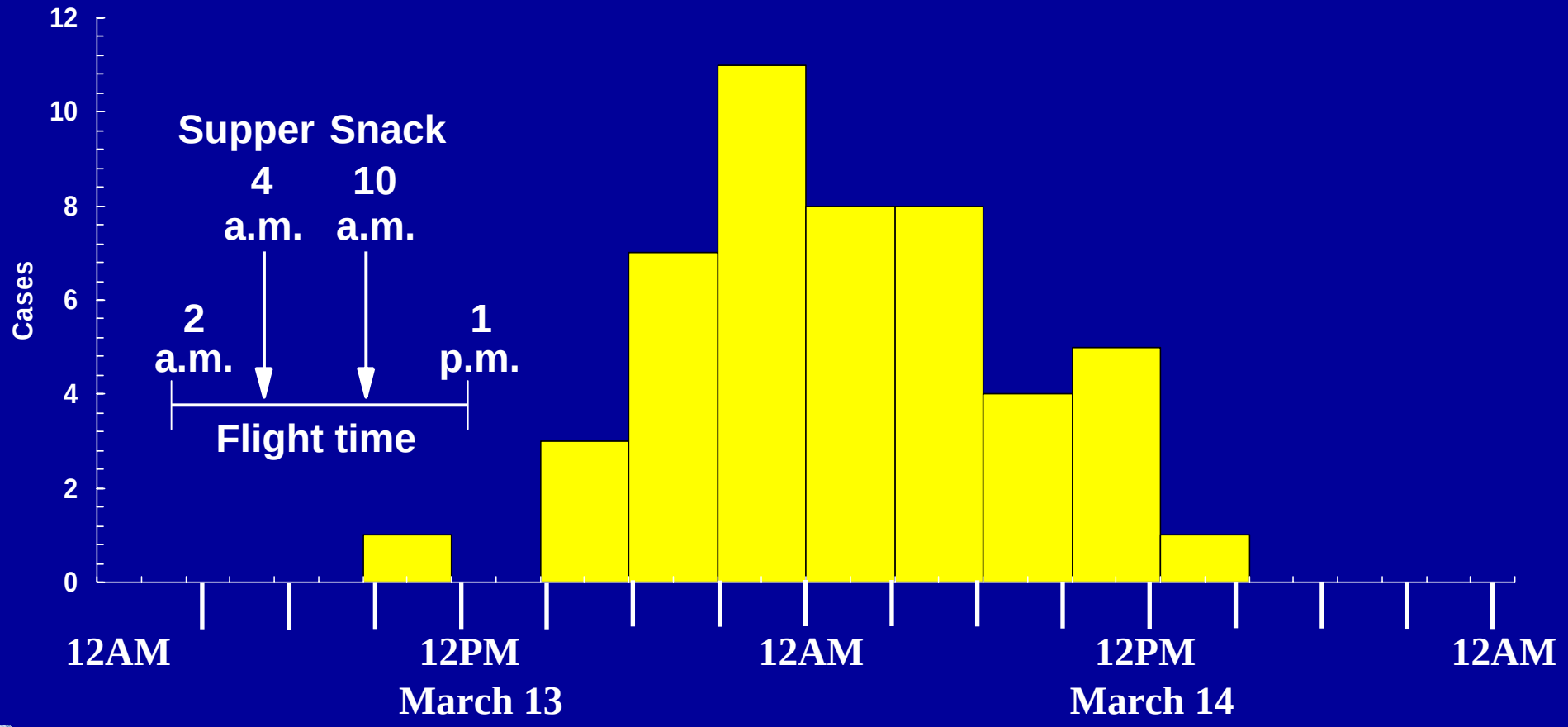
Correlation of hospital course of hepatitis A source patient with laboratory values and onset of illness in secondary cases --- Georgia, September 1--October 31, 1980

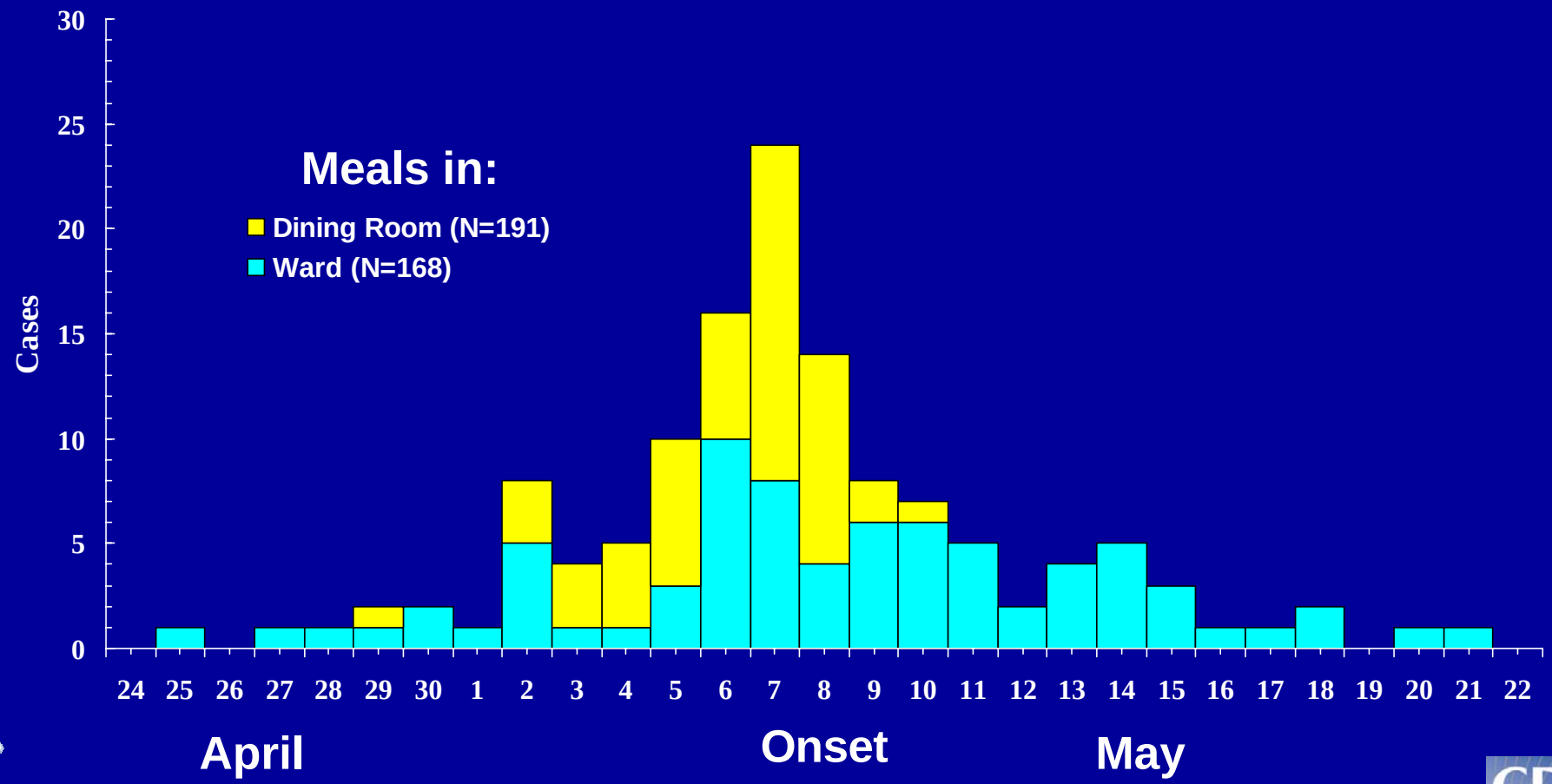


(Source: Goodman et al.1982.)

Salmonellosis in passengers on a flight from London to the United States, by time of onset, March 13--14, 1984

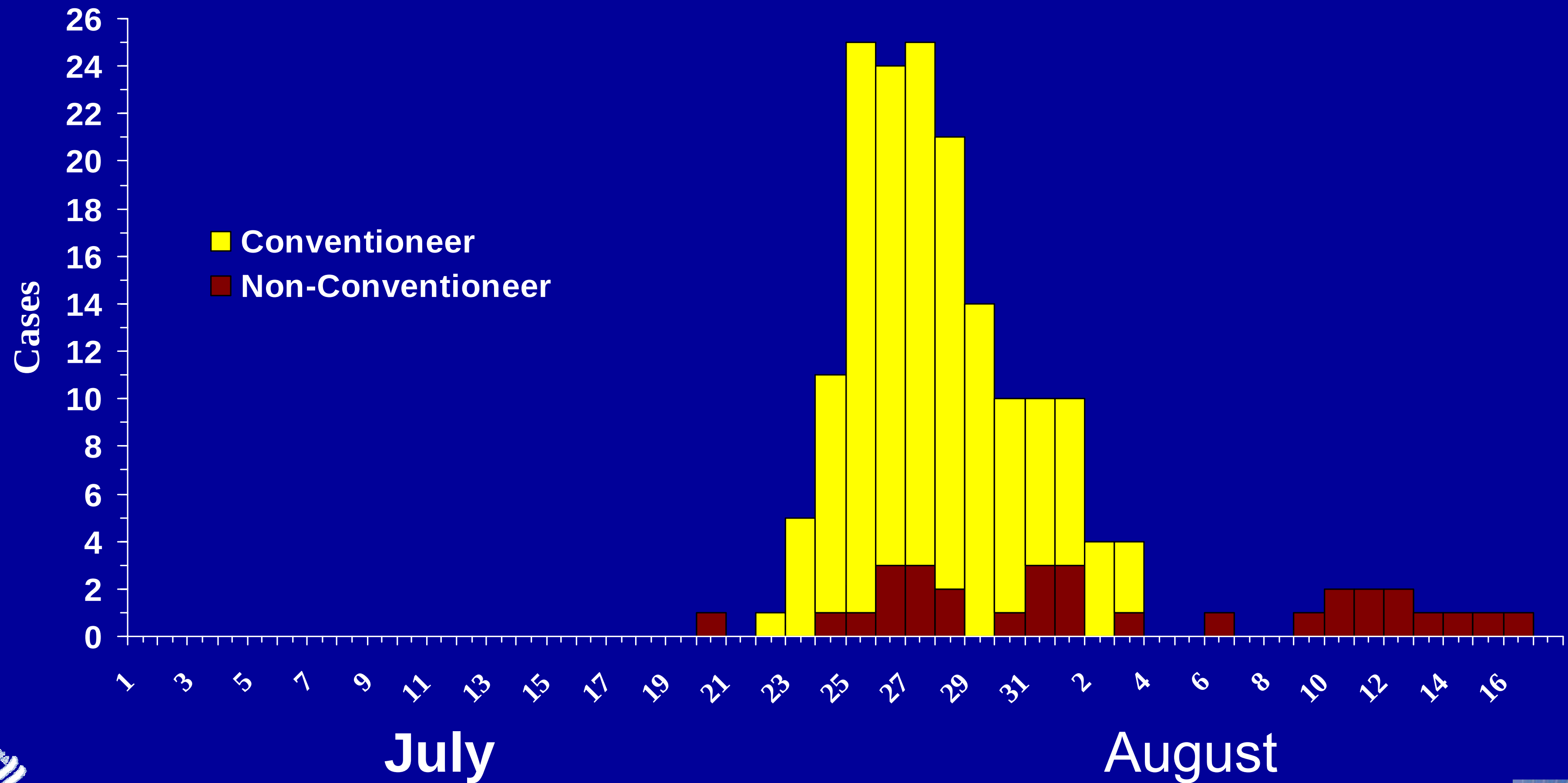


Cases of Influenza-like Illness Among Residents of a Nursing Home in Rural Minnesota. April 24-May 21, 1979



Legionnaires' Disease

By date of onset, Philadelphia, July 1-August 18, 1976



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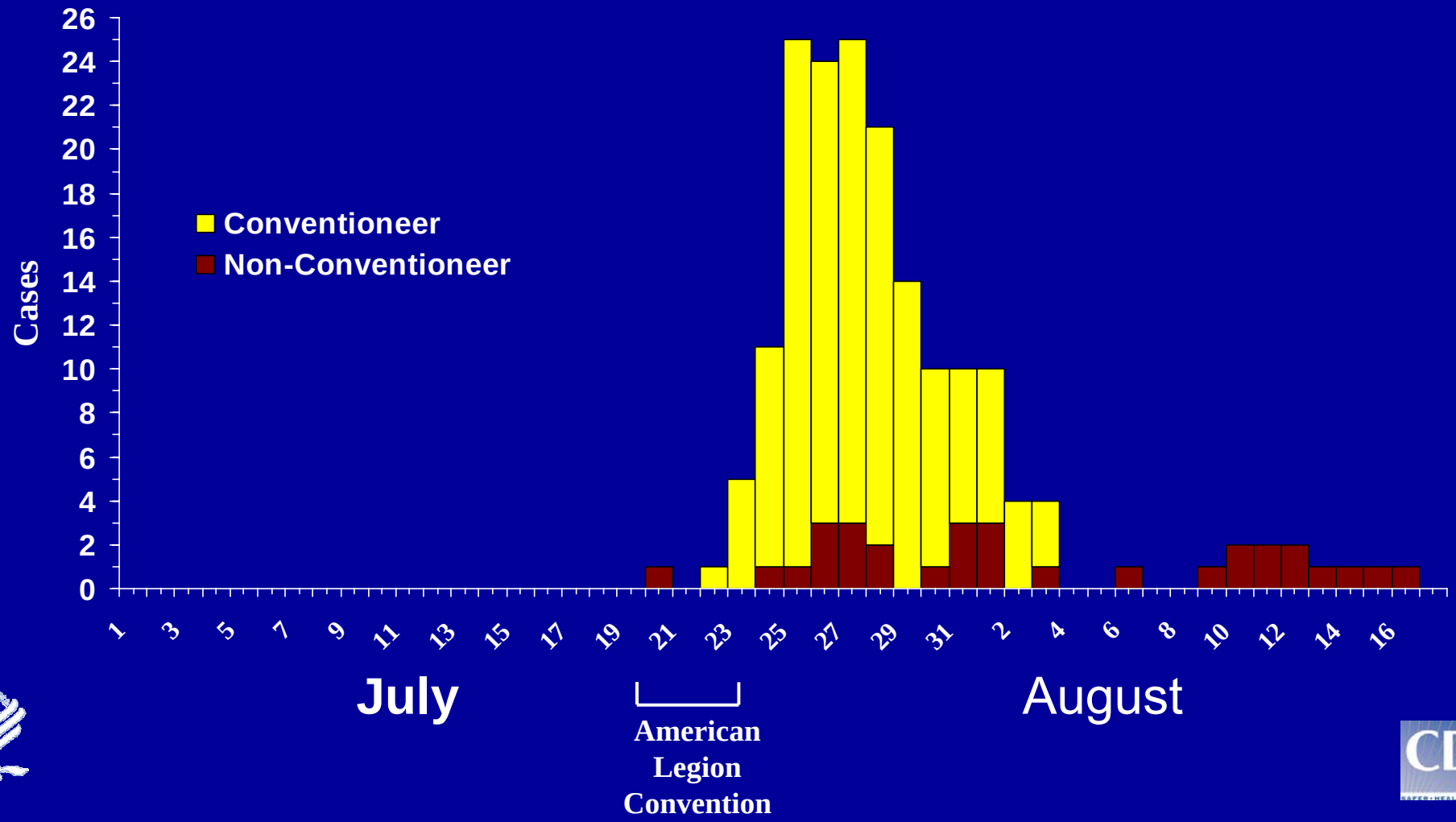
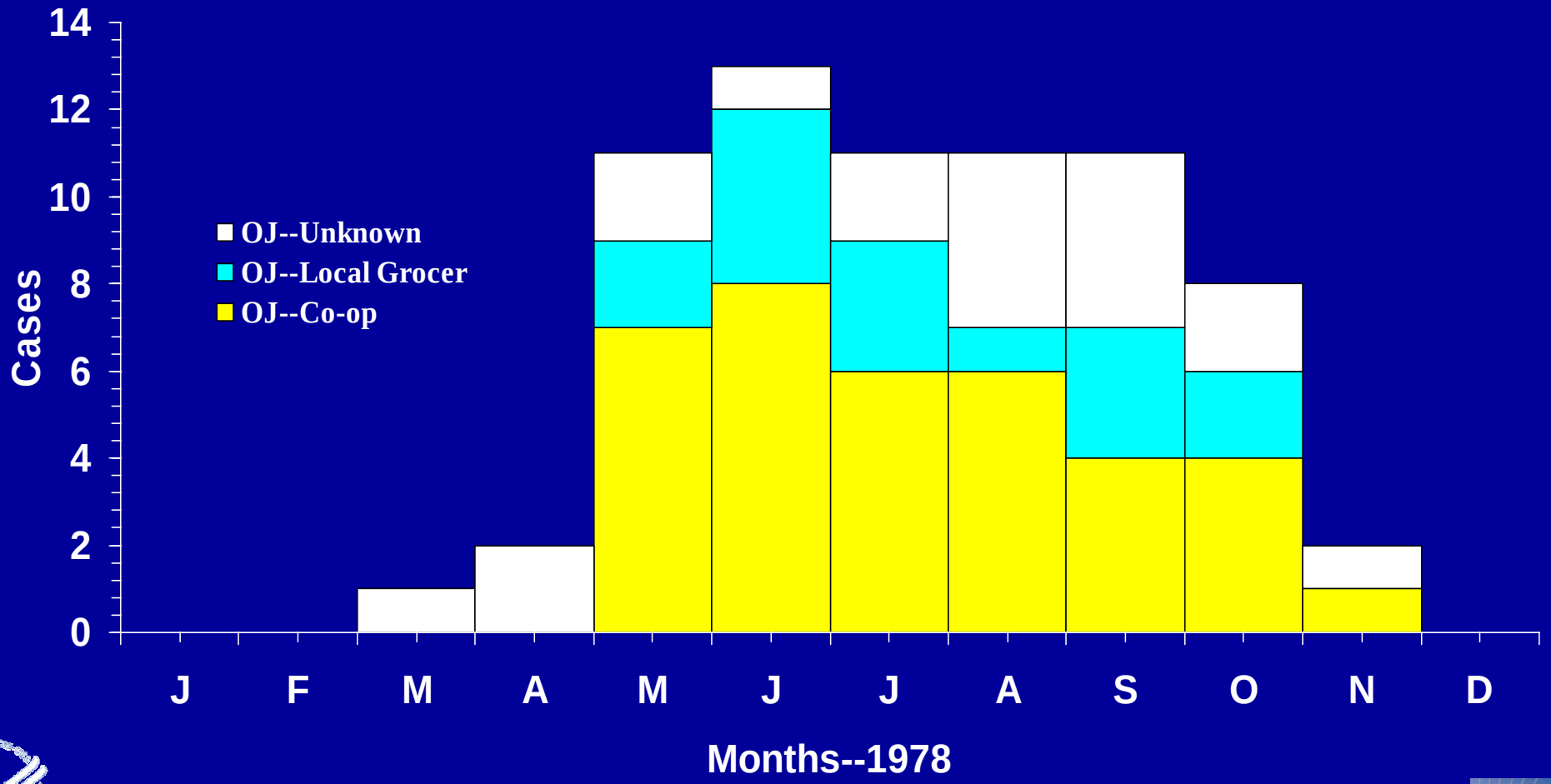
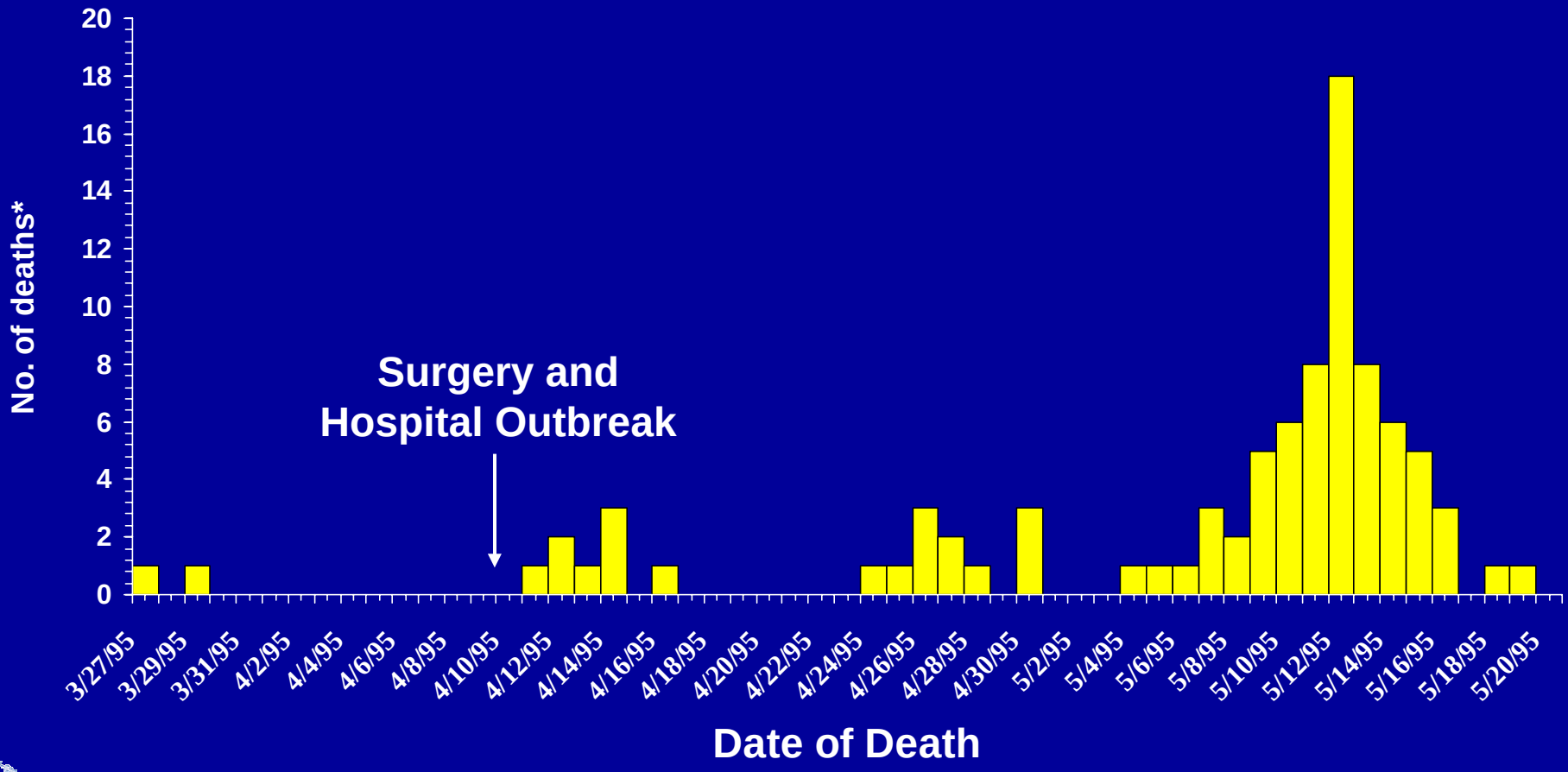


Distribution of NonB Hepatitis Cases By Month of Onset



VHF Deaths, Bandudu Province, Zaire. March - April 1995



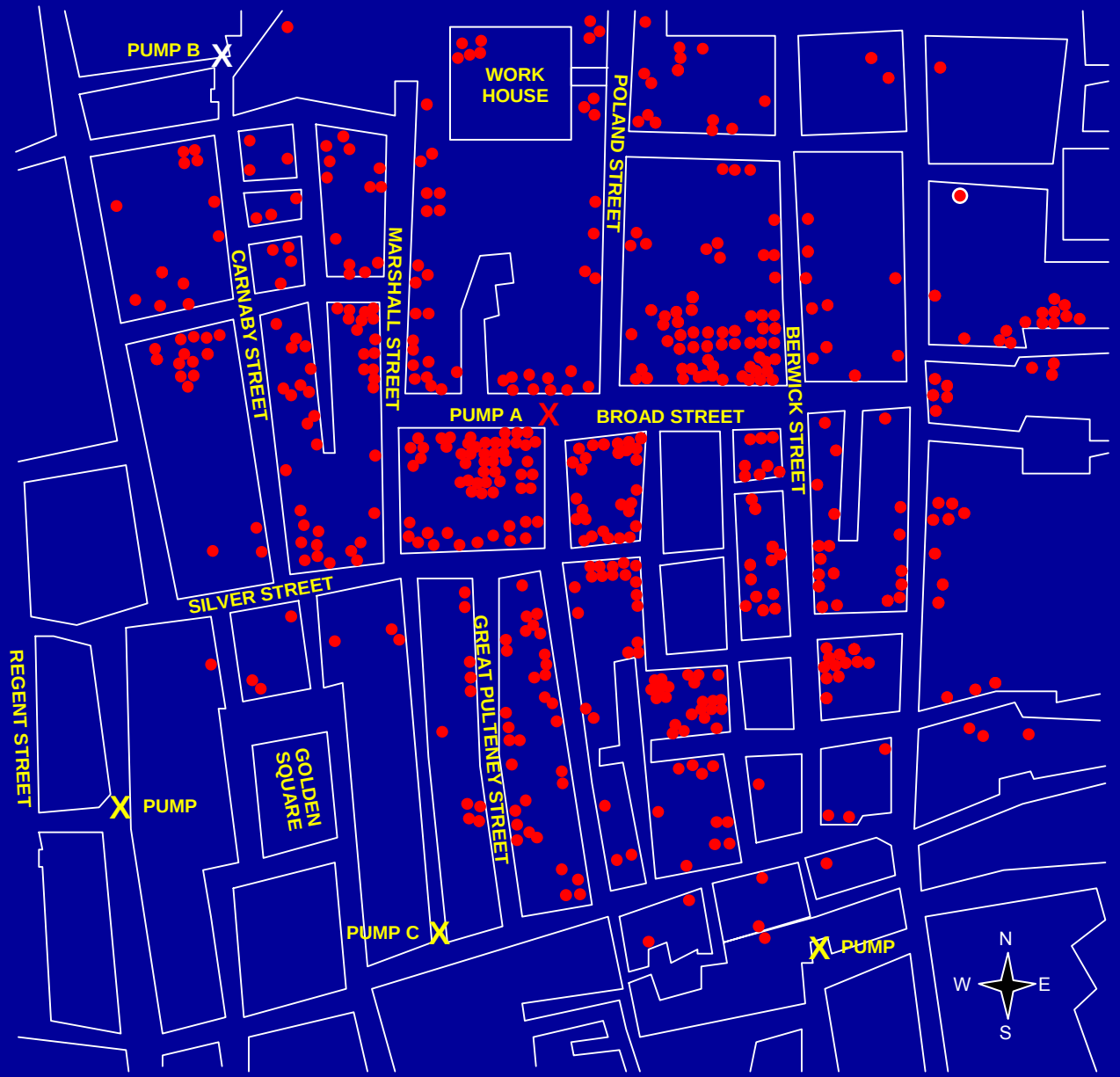
*Note: 7 deaths with unknown date of onset

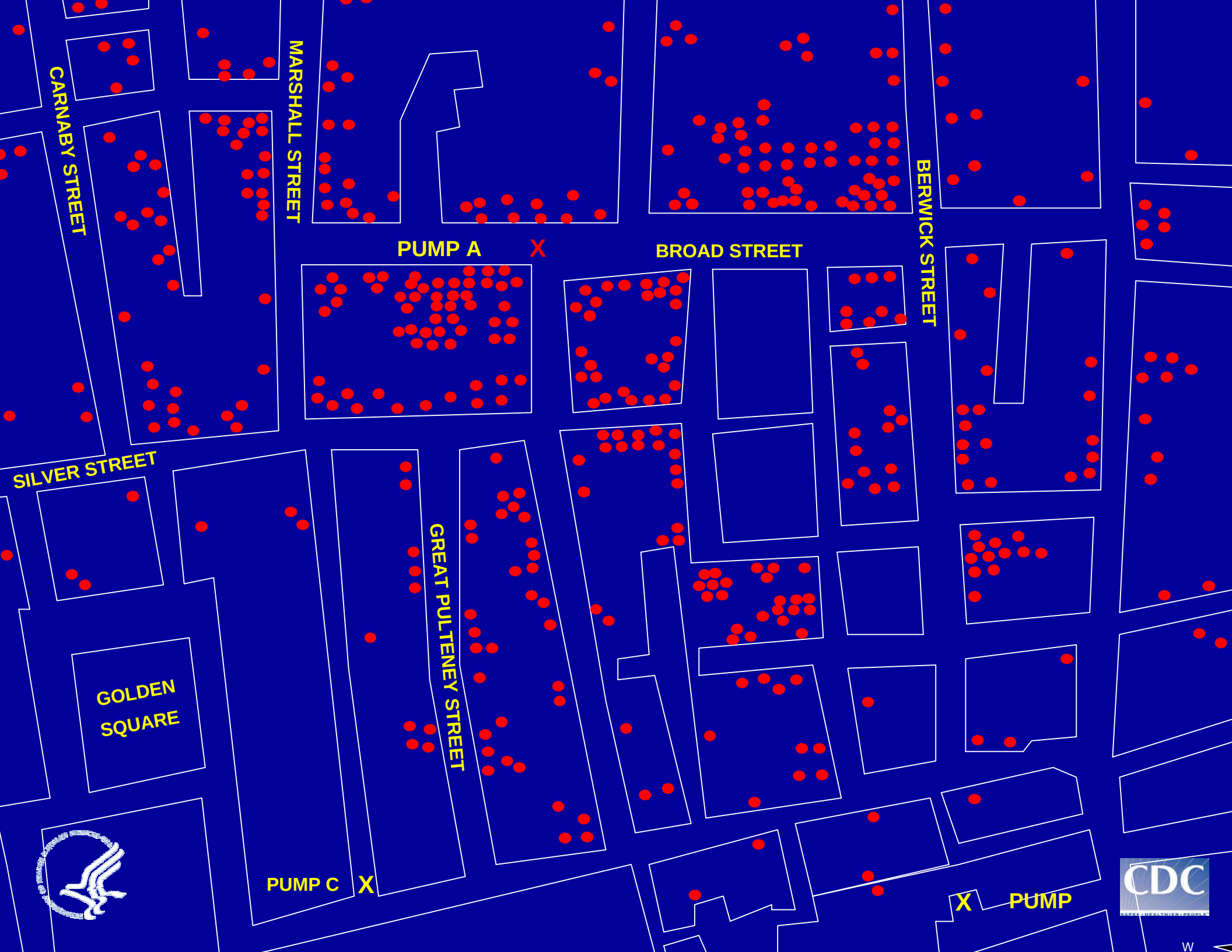
Place

- Orient to:
  - place of residence
  - place of occupation
  - activity sites

- Spot map: specific residence and/or exposure
  - within buildings
  - city blocks or neighborhoods
  - county or state level

Distribution of cholera cases and implicated water well --- Golden Square area of London, August--September, 1848




CARNABY STREET
MARSHALL STREET
BERWICK STREET
PUMP A
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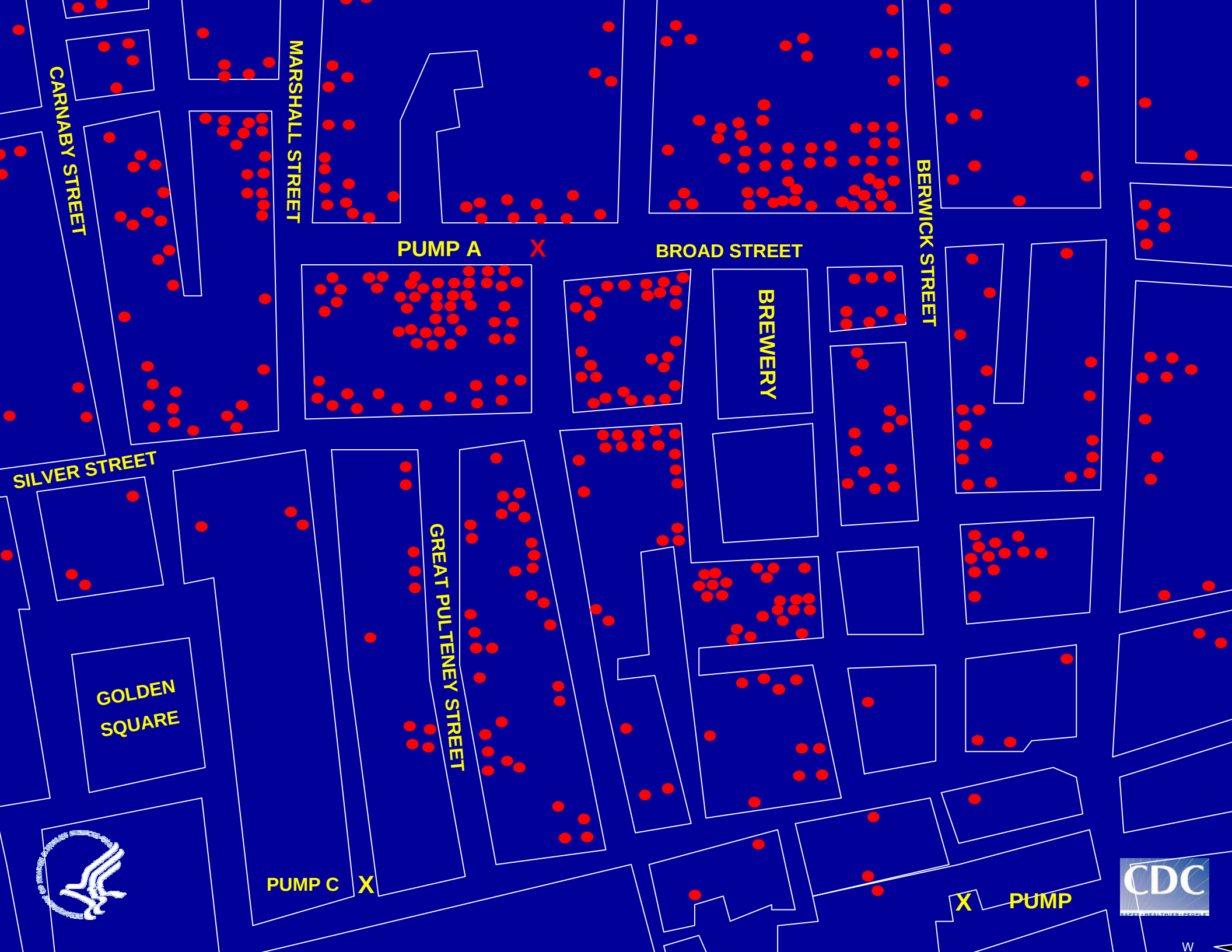
BROAD STREET
SILVER STREET
GREAT PULTENEY STREET
GOLDEN
SQUARE
PUMP C
X
X
PUMP
CDC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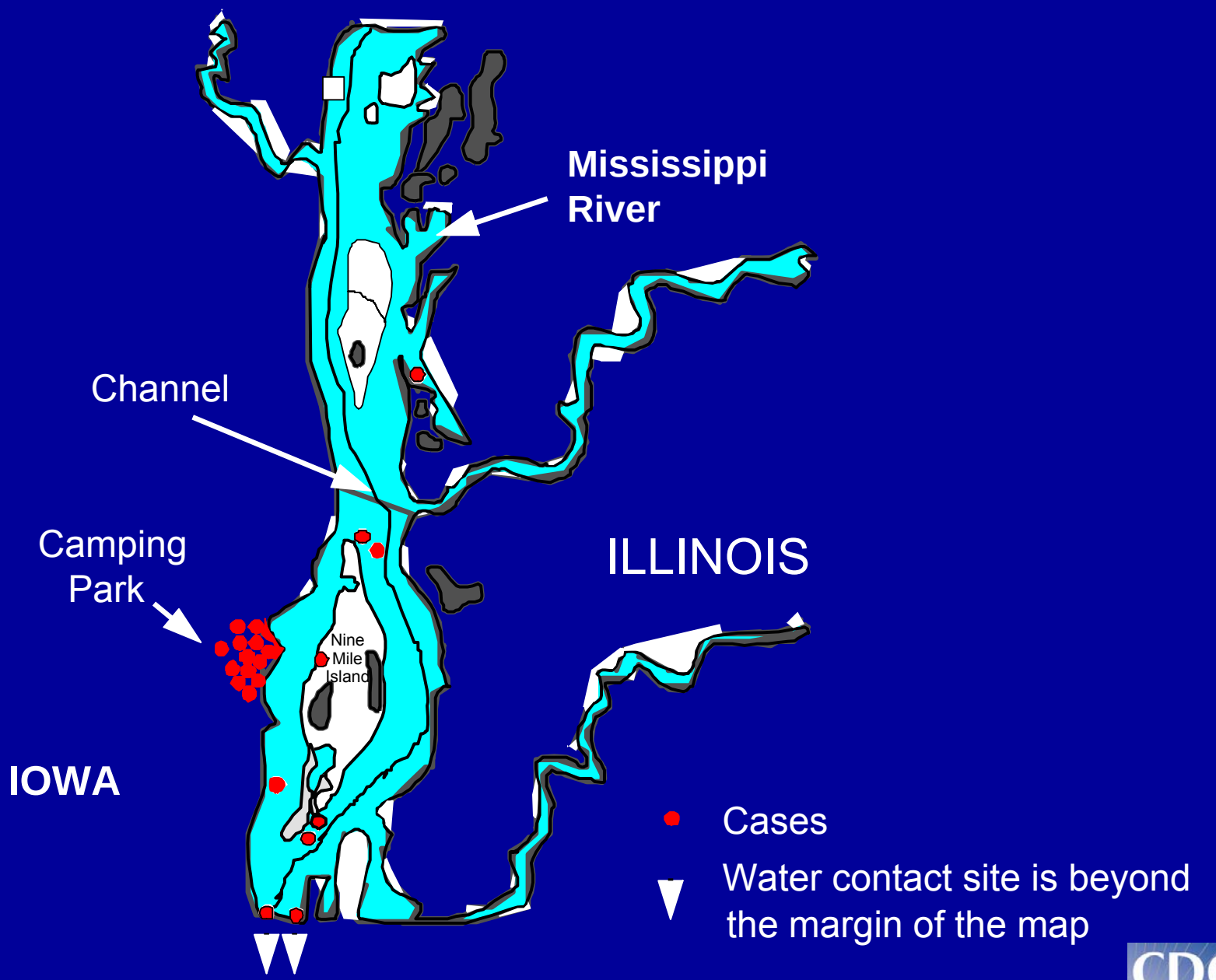
CDC

Culture-positive cases of shigellosis, by sites along the Mississippi River where each case swam within three days of onset of illness --- Dubuque, Iowa, September, 1974



Source: Rosenberg, et al.1976

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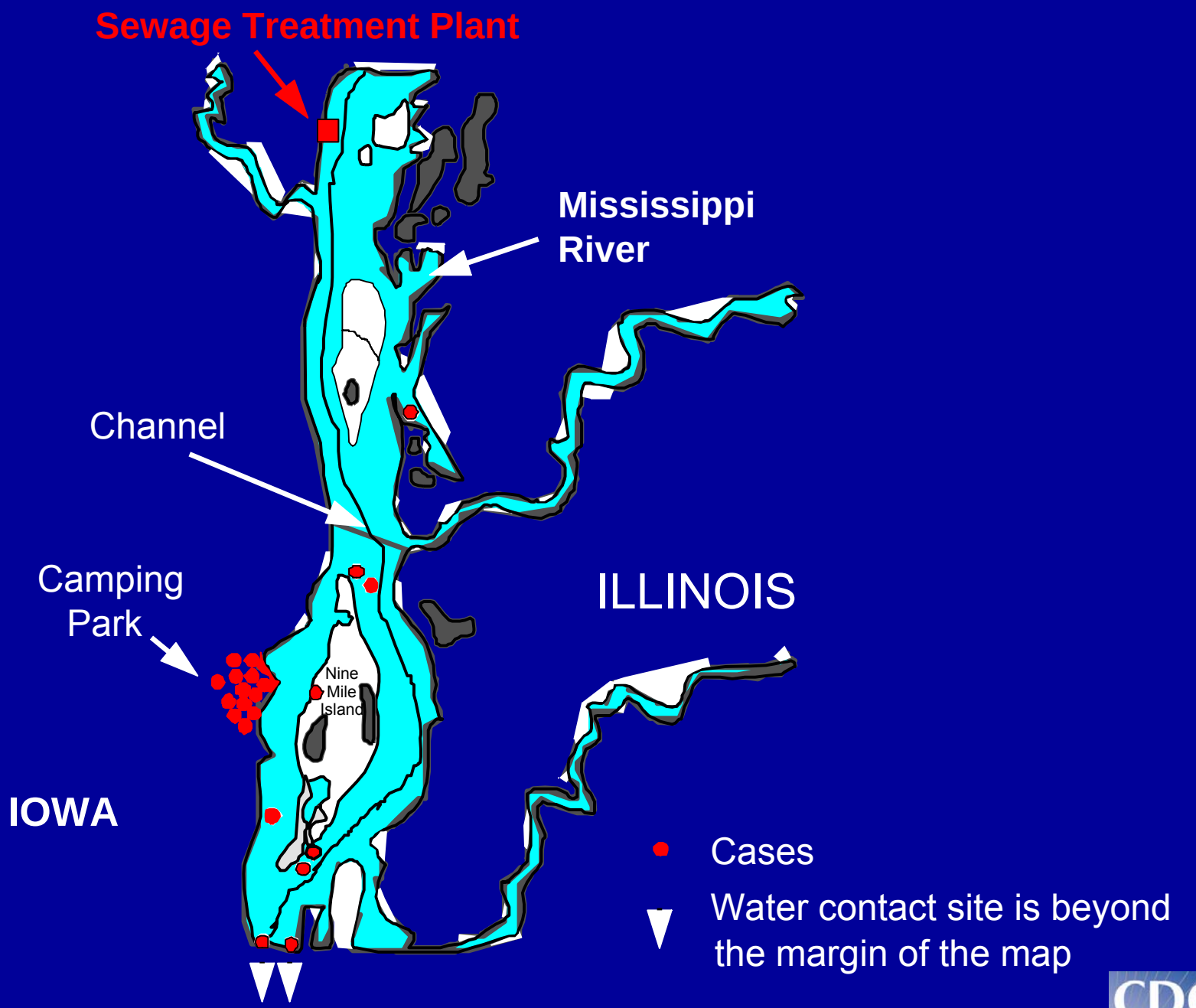
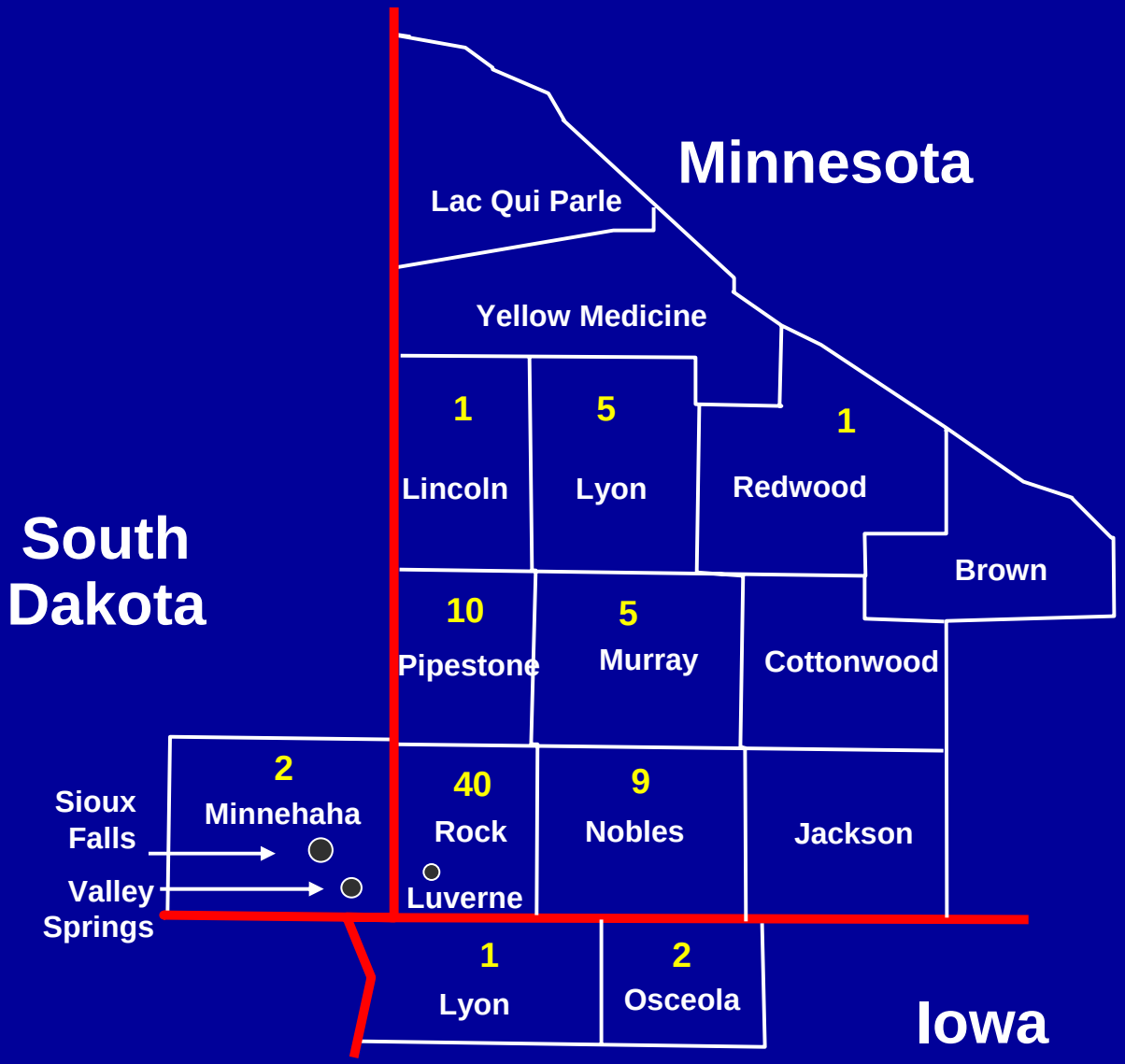


Source: Rosenberg et al.1976.

Incidence per 10,000 persons of thyrotoxicosis by county --- Minnesota, South Dakota, and Iowa, Feb 1984 - Aug 1985



Person

- Thoroughly describe the case group
- Identify factors shared in common by cases
- Obtain denominators to derive rates
- Compare groups

Formulate and Test Hypothesis

- Goal: explain the problem
- Use comparison group(s)
  - case-control study
  - cohort study
- Consider causation

Implement Control Measures

- Eliminate/treat source
- Cohorting
- Prevent further exposures
- Protect at-risk population

Communicate Findings

- Purposes:
  - formally convey recommendations
  - institutional requirements
  - record for future reference
  - rapid dissemination
  - share experience
- Forms:
  - preliminary written report
  - final report
  - public health bulletin
  - journal article
  - abstract
  - meeting presentation